

Claims

1. An apparatus for low-pressure wire bonding of an integrated circuit chip to a substrate, said apparatus comprising:
 - a metallic interconnect within said substrate; and
 - an alloy material between said interconnect and a metallic wire connected to said integrated circuit chip, said alloy material including a composition of said metallic wire material and an alloying metal.
2. The apparatus of claim 1 wherein said metallic interconnect includes copper.
3. The apparatus of claim 1 wherein said alloy material comprises a low temperature material including Au-Sn or Au-In.
4. The apparatus of claim 3 wherein a concentration of said Sn of said alloy material is used to vary said alloy material's melting point to be greater than that of said alloying metal.
5. The apparatus of claim 1 wherein said metallic wire is comprised of gold.
6. An apparatus for low-pressure wire bonding on a substrate, comprising:
 - a metallic interconnect within said substrate, said metallic interconnect having a top, bottom, and sides, surrounded on said bottom and said sides with a metallic diffusion barrier layer;
 - a metallic barrier cap over said metallic interconnect, wherein at least a portion of said barrier cap is comprised of alloy material; and
 - a metallic wire attached to said alloy material having alloying metal, such that the combination of said alloy material and material of said wire react to form an alloy bond.
7. The apparatus of claim 6 wherein said metallic interconnect is comprised of copper.

8. The apparatus of claim 6 further comprising a passivation layer over said barrier cap, wherein a portion of said passivation layer is removed.
9. The apparatus of claim 8 wherein said metallic wire attaches to said alloy material where said portion of said passivation layer is removed.
10. The apparatus of claim 6 wherein said alloy material comprises a low temperature material including Au-Sn or Au-In.
11. The apparatus of claim 6 wherein said alloy material melting temperature is adjusted such that it is greater than that of said alloying metal.
12. The apparatus of claim 10 wherein a concentration of said Sn of said alloy material is used to vary said alloy material's melting point to be greater than that of said alloying metal.
13. The apparatus of claim 12 wherein said concentration of said Sn of said alloy material is further adjusted for lead-free wire bond attachments.
14. The apparatus of claim 6 wherein said diffusion barrier includes TiN, W, TiW, Ta, TaN, Ni, NiP, CoP, or CoWP.
15. The apparatus of claim 6 wherein said metallic wire is comprised of gold.
16. A substrate for low-pressure wire bonding on a substrate, comprising:
 - a metallic interconnect within said substrate, said interconnect having a top, bottom, and sides, surrounded on said bottom and said sides with a metallic diffusion barrier layer;
 - a metallic wire having a body and endpoint, having a coating, at least at said endpoint, of an alloy material comprising alloying metal;
 - said metallic wire attached to said interconnect such that the combination of said alloy material and said metallic wire material react to form an alloy bond with said interconnect.

17. An apparatus for low-pressure wire bonding on a semiconductor substrate having a top surface, comprising:

- a copper interconnect within said substrate and below said top surface of said substrate, said copper interconnect having a top, bottom, and sides, surrounded on said bottom and said sides with a first metallic diffusion barrier layer;
- a first dielectric diffusion barrier layer over said copper interconnect top;
- a portion of said substrate over said copper interconnect removed, such that a portion of said copper interconnect is exposed;
- a second metallic barrier layer covering said substrate top surface and covering said exposed portion of said copper interconnect;
- an aluminum bond pad deposited within said removed portion of said substrate, over said exposed portion of said copper interconnect;
- a third metallic diffusion barrier over said aluminum bond pad;
- a layer of alloy material including alloying metal applied over said third barrier;
- a wire attached to said alloy material, such that the combination of said alloy material and material of said wire react to form an alloy bond.

18. The apparatus of claim 17 further comprising:

- a composite silicon layer; and
- a polyimide layer;

said composite silicon layer and said polyimide layer applied over said apparatus such that a portion of said alloy material layer is left exposed for attaching said wire.

19. The apparatus of claim 18 wherein said composite silicon layer includes silicon nitride or silicon dioxide.

20. The apparatus of claim 17 wherein said first barrier layer comprises silicon nitride, and said third diffusion barrier comprises TiN.